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focus will be refracted towards the other and the two points  $E$  and  $E'$  are therefore conjugate foci, and  $f$  and  $f'$  may be substituted for  $OE$  and  $OE'$ .

A very similar solution which need not be given here can be obtained for the cases where one focus lies between  $Q$  and  $F$  or  $F'$  and the other on  $QE$  or  $QE'$  produced and which result in virtual instead of real images.

This equation applies to the refraction at one lens surface. For simple lenses or for lens systems two or more equations, according to the number of refractions, must be combined.

When the cone of light is narrow and does not diverge far from the optical axis the last factor  $\cos a/\cos b$  becomes practically 1. This produces the simplest form of the equation. It can be used in calculating the foci of thick lenses in case the aberrations are neglected.

For the study of aberration the angles  $a$  and  $b$  can be calculated by solving the two triangles  $EDO$  and  $QDO$  in which  $EO$  and  $QO$  remain constant and the other sides vary according to the refractive index of the color of the ray of light investigated in the study of the chromatic aberration, or according to the position of  $Q$  when studying spherical aberration.

The usual equation found in the books can not be employed for either of the foregoing calculations when more than approximate results are required.

C. W. WOODWORTH

## ANTHROPOLOGY AT THE WASHINGTON MEETING

### II

*A New Type of Ruin Recently Excavated in the Mesa Verde National Park, Colorado:* J. WALTER FEWKES.

An account of the excavation and repair of a new type of ruin on the point of a mesa opposite Cliff Palace, conducted under the auspices of the Interior Department and the Bureau of American Ethnology. Before the work was begun, the existence of a large building was indicated by a large mound, the surface of which was strewn with artificially fashioned stones, partly covered with soil, with a few feet of wall showing at one point. On top of the mound, at a place found later to indicate the highest wall, grew a large cedar tree,

a cross-section of which revealed 360 annual rings. The building excavated is D-shaped, measuring 122 feet on the straight side and 64 feet broad. The standing walls now contain 120,000 cubic feet. The facing of the walls is artificially pecked with stone implements, and in many instances rubbed smooth. Many stones set in the walls or found in the debris bear incised ornamentation, the beginning of mural embellishment. The masonry is not only among the best in any prehistoric building north of Mexico, but the building itself is the most mysterious yet brought to light in our southwest.

There are evidences that it was neither completed nor inhabited, and evidently it was not intended for habitation. Its ground-plan exhibits a unity in design and a strict adherence to that plan throughout the construction of the building. It is believed to have been constructed by the neighboring cliff-dwellers; it is prehistoric and regarded as more modern than Cliff Palace. A fossil leaf of a palm in relief on the upper surface of the cornerstone at the western end of the building is believed to be a sun symbol, and the walls about it a solar shrine. The building is regarded as a sun temple of the neighboring cliff-dwellers, and is the first of its type yet excavated in the Mesa Verde National Park.

*The Passing of the Indian:* JAMES MOONEY.

The subject of the aboriginal population of America, and more particularly of the United States, at the first coming of the white man, has been a matter of much speculation, but of very little detailed investigation. There has been about as much error and loose statement on one side as on the other, some theorists claiming for the pre-Columbian period a dense population for which there is no evidence in fact; while others, largely those interested in various civilizing schemes, maintain that the Indian has held his own or is even actually increasing. The claim for a dense earlier population is based chiefly on ignorance of Indian living habit and the error of assuming as contemporaneous in occupancy settlement remains belonging to widely separated periods. The argument for stability or increase of the Indian population rests in part on the error of beginning the calculation with the beginning of federal relations with the tribes, ignoring the centuries of colonization and disturbance which preceded that period, and is also colored to some extent by a desire to draw good results from philanthropic and civilizing efforts.

Another source of confusion in this direction is in the improper designation as "Indian" for administrative purposes, of any individual who can establish even the most remote and diluted Indian ancestry. Thus we have upon the official rolls, and thereby legally entitled to full Indian rights, thousands of persons whose pedigrees show one-thirty-second, one-sixty-fourth, or even less of Indian blood. We need an official, or at least an ethnologic, definition of an Indian, based on the actual proportion of Indian blood. In a detailed study of past and present Indian population of the United States and northern territories, undertaken for the Bureau of American Ethnology, Mr. Mooney arrives at the conclusion that the entire Indian population north of Mexico at the period of earliest white occupancy was approximately 1,140,000, of whom about 860,000 were within the present limits of the United States. The total number has been reduced by about two thirds through disease, famine and war, consequent on the advent of the white man.

*Indian Missions in North America:* J. F. X. O'CONOR.

Indian missions were established in various states of North America during two hundred and fifty years, from 1613 to 1776, and from that date to 1893. The Indian tribes evangelized during that period were the Abnakis and the Iroquois, the Ottawas, Illinois, Mohawks, the Hurons, Onondagas, the Oneidas, Cayugas, Senecas, Seminoles, the Neuter Nation and the Algonquins, the Kaskaskias, the Natchez tribe, the Yazooos, the Sioux, the Chickasaws and the Nezperces, the Coeur d'Alenes and the Miamis, the Alabamas and the Susquehannas. The Jesuit missionaries visited all these tribes, and among many built churches, mission houses and schools. They lived with the Indians, traveled with them, taught them and strove in every way to bring to them the advantages of Christianity and civilization. They traversed every section of that territory now the United States, from Maine to California, and from the Great Lakes to Florida. These Indian missions were connected with the discovery of the falls and river of Niagara, the discovery of the Mississippi by Marquette, and of Lake George and the salt mines of Syracuse. The records of these earlier missionaries are the most authentic and reliable accounts of the early days of America, and of the lives, customs, occupations, character, in peace and war, of the Indian tribes of North America.

Volumes have been written by the missionaries on the lives and habits of the North American Indian, and the earlier valuable editions have been republished in the monumental series of the "Jesuit Relations" or "Histories of the Indian Missions," by R. Goldthwaites, secretary of the State Historical Society of Wisconsin.

*Recent Developments in the Study of Indian Music:* FRANCES DENSMORE.

The study of many sciences is dependent, to some extent, on mechanical aid, and the progress of such sciences is measured by the invention or adaptation of such aids. The invention of the phonograph and its recording apparatus marked an epoch in the study of Indian music. It seems probable that the next epoch-marking invention bearing on this study will be that of a device for accurately measuring small intervals of tone.

The musical system in use among civilized peoples contains certain fundamental principles, among them being (a) the importance of the keynote, octave, and dominant of the scale, and (b) the use of a unit of rhythm. A melodic and rhythmic analysis of six hundred Indian songs (Chippewa and Sioux) shows that the same fundamental principles underlie the structure of a majority of these songs.

The interval of the minor third characterizes the folk-songs of certain European peoples, some of the ancient music of the white race, and the songs of many uncivilized tribes. Analysis of the above-mentioned Indian songs shows that (a) the minor third is the interval of most frequent occurrence, and (b) the average interval in these songs comprises 3.1 semitones, which is approximately the number of semitones contained in a minor third.

Besides the studies mentioned, tests of tone perception were made among Chippewa and Sioux Indians, with interesting results.

*The Beaver Indians:* P. E. GODDARD.

The Beaver have hitherto received little or no attention from ethnologists. They live in the Peace River district in northern Alberta, with bands of Cree separating them from the Plains area. Life seems to have been simple in that region, consisting mainly in a severe struggle for food. They depended largely on hunting and trapping, resorting to fishing only in the lack of other food. By means of caches, transportation was avoided as much as possible. Religious life, while simple and devoid of elaborate ceremonies, was emotionally strong. The Beaver fall in with the Slavey and Chipewyan in other particulars

besides language. Their only connections with their linguistic relatives to the south, the Sarsi, seems to have been only recent.

*The Growth of the Tsimshian Phratries:* C. M. BARBEAU.

In nine unfederated tribes of the Tsimshian proper the phratries were unevenly represented. Evidence shows that the structure and distribution of the four phratries have undergone considerable change in recent times. The phratries, as they now stand, consist of clans either grown out of each other, or introduced from outside and incorporated mostly on account of political circumstances.

*The Huron-Wyandot Clans:* C. M. BARBEAU.

The exogamic and totemic clans of the Huron-Wyandots are at the basis of their social structure. At least two out of eleven clans are modern and confined to one section of the tribe. The remaining nine clans seem once to have been grouped into two opposite phratries with one odd clan, but the evidence to this effect is slender. The grouping of clans within such phratries must have been largely accidental and of comparatively short duration, since there is barely any record bearing on their existence, and practically no survival.

*Herb Medicine Practises of the Northeastern Algonkins:* FRANK G. SPECK.

This paper presents lists of plants used in the medicine practises of several eastern Algonkin tribes—the Montagnais, Penobscot and Mohegan. Practically devoid of ceremonial associations in this area, the pseudo-scientific use of herbs by the northeastern tribes is taken as another indication of the primitive character of their culture. Assuming that a simple herbalism unmodified by ritual is more elementary than where subordinated to ceremonial practises, the author brings forth another reason for regarding the northeast as a region where a fundamentally characteristic type of Algonkian culture has survived unmodified by contact with outside and more advanced types. The associations of color, taste, name and the like, are shown to underlie the remedies and their functions in most cases, as appears in the botanical identifications and the analyses of native names.

*The Social Significance of the Creek Confederacy:* JOHN R. SWANTON.

The Creek confederacy was a result of those social linkings from which, in all parts of the world, nationalities and governments have arisen.

Although it originated among peoples related by language and bound together by similar customs and a similar economic life, the constituent parts had themselves been subjected to still earlier unifying tendencies, as is evidenced by their clan systems, and to some extent by their known history. Their gradual consolidation was in accordance with a certain plan having both social and religious aspects, a plan itself probably evolved progressively with the organization. It had a religious seal in the shape of a myth in which a supernatural origin and character were attributed to it.

As with similar complexes elsewhere, some of which have been brought about more rapidly, the Creek organization resulted from a progressive surrendering of cultural, religious and governmental independence by the several parts and approximation toward a typical mean. The relation of the various incorporated tribes, towns and clans to each other and to the entire body, the dual division of towns and of clans, and the method of sharing out the functions of the collective body all bear witness to this evolution and furnish material for comparison with the development of social bodies in other parts of the world.

*Notes on the Sign Language of the Plains Indians:* HUGH L. SCOTT.

After referring briefly to the development and communication of the languages in general and of the American languages in particular, the author treats of the language of signs employed by divers indigenous tribes which inhabit the region extending from the Mississippi River to the Rocky Mountains and from the Saskatchewan River in British Columbia to the frontiers of Mexico. He also refers briefly to the principal dialects of the American Indians and to the fact that these dialects served as an international vehicle of communication.

With respect to the language of signs, the author demonstrates that it is one of the natural modes of communication and that it obeys the general law of linguistics, with exception of those concerned with phonetics. He traces the history of sign language which in his opinion appeared in the year 1535 of the Christian era and perhaps at a more remote epoch. The author then refers to the opinions and data which the first chroniclers and historians of Spain secured with respect to this language. These Spanish chroniclers and historians make it clear that this language existed in Mexico and was replaced by the spoken language of the Aztecs. The author compares the

signs used by the Indians with those employed by deaf mutes and indicates the origins of the Indian sign language, citing cases related to this class of language which were referred to by Homer in the "Odyssey." In speaking of the signs of the Indians the author treats of pantomime as a means employed in the communication between races of distinct ethnic origin from times of the most remote antiquity. He then refers to the particular sign language of the North American Indians and to the origin and propagation of the signs, as well as to the grammatical rules to which the sign language was subject.

*Omaha and Osage Traditions of Separation:*  
FRANCIS LA FLESCHÉ.

Before the advent of Europeans the Indians had no means other than by oral accounts to transmit their rituals and stories of important events. Narratives, in their transmission, often lost important details of time or place. Accounts of changes that occurred in a tribe became reduced to a few words, as in the story of the separation of the Omaha from the Osage. The Omaha story of the separation came down in two versions: One tells of the attempt to cross the Mississippi in skin boats, of being separated by the rising of a heavy mist; the other, of their efforts to cross the river by means of grapevines spliced together.

On the visits of the Omaha to the Osage and the Quapaw, members of these tribes say to their visitors: "You were a part of us, but you went away in an angry mood and never came back, because in the distribution of sinew you were slighted."

An Osage who recently visited the Omaha gave the detailed story, here recounted, of the separation as told by one who was a recognized authority on the traditions of the Osage. In this story it was shown that at a tribal ceremony two leaders were reproofed for violating the hunting usages. Taking offense at this reproof, the two leaders broke away from the tribe with many of the families of the various gentes, and these afterward organized and became known as the Omaha tribe.

*Zuñi Conception and Pregnancy Beliefs:* ELSIE CLEWS PARSONS.

Description of two phallic shrines. To give birth to a girl, men sent out of house during labor. Conception ceremonials. Conception of twins through practises relating to deer. Deer bearing twins. Pregnancy taboos: dyeing wool, firing pottery, viewing a corpse, eating pine nuts, standing at a window, scattering bran on oven floor. Albinism due to parent eating white leaf inside the

corn husk; blindness or lameness or malformation to expectant father shooting animals in the eyes, legs, etc. Birth-marks due to father dancing in a ceremonial during the pregnancy; crying from pain in the back, to maltreatment of horses; deafness, to mother stealing before the birth. Curing by inoculation magic.

*Some Esoteric Aspects of the League of the Iroquois:* J. N. B. HEWITT.

In the esoteric thinking of the early prophetic statesmen of the Iroquois and their co-tribesmen, the League of the Five Tribes as an institution, an organic unity, was conceived as a bi-sexed being or rather person, *i. e.*, an organic whole or totality formed by the union of two human persons of opposite sex. This conception appears in the organic parts of the institution and in the ritual governing the installation of its officers and of those of its constituent organic parts. Owing to the vastly differing viewpoint of the civilized man of to-day from that of the founders of the league, this esoteric meaning with its implications is, perhaps, strange and he may apprehend it only as metaphor, because to him it is only poetic.

To those early prophetic statesmen, life was omnipresent; obtrusively so. For, unconsciously, it had been imputed by their ancestors to all bodies and objects and processes of the complex world of human experience. The life so imputed was human-like life. And so as an organic totality, the league of the Iroquois was conceived as an animate person or being, endowed with definite biotic properties or functions; among these characters may be mentioned male and female sex, fatherhood and motherhood, mind, eyesight, dream-power, human blood; it was also conceived as having a guardian spirit, even as its essential organic parts had. These were distinct from those possessed, or supposed to be possessed, by the persons who composed the people of the league. In the ritual of installation of chiefs, each of the constituent persons, the father and the mother principles represented in the league, is addressed as a single individual, in all of the many addresses and chants and songs. In the so-called Six Songs, which are so dramatically sung by one representing the dead chief to be resurrected, each of these constituent persons is addressed, but in the fifth song the Totality, the League as a Unity, is addressed as a person, for in its honor is this fifth song being sung.

*Tribes of the Pacific Coast:* A. L. KROEBER.

This paper analyzes a commonly accepted cul-

tural differentiation between the Indians of the narrow belt of the Pacific coast, from southern Alaska to southern California, and those of the remainder of the continent. The difference is found not to extend to specific elements of native civilization, but to consist in the use to which such specific elements are put by the two groups of peoples or the setting in which the elements are placed. The difference is traceable in material aspects of culture, such as agriculture and the art of pottery-making, and in non-material, as political organization, the employment of property, and ritualistic expression in religion.

While the culture of the Pacific coast tribes thus forms a well-marked unit distinct from the comparatively uniform culture of the remainder of America, it does not reveal any indications of definite connection with Asiatic civilizations, either in type or in source. Its origins must be sought in America. When the extreme and puzzling linguistic diversity of the Pacific coast is examined, in the light of recent comparative philological studies, this diversity appears to be not fundamental, but the result of a differentiating inclination connected with the peculiar type of political organization on the Pacific coast. The linguistic relationships also indicate that the Pacific coast has long been a fairly defined historical area, whose development and population have proceeded at least for several thousand years, from within rather than by importation and immigration.

*The Relationship Terms of the Crow and Hidatsa Indians:* ROBERT H. LOWIE.

The various principles determining the development of kinship terminologies have become clear through the writings of Morgan, Rivers and others. The time has now come for testing their relative efficacy in concrete instances and within restricted areas. More particularly is it desirable to compare the nomenclatures of very closely related tribes and to correlate empirically observed changes with probable causes. The Crow and Hidatsa systems furnish an instructive case in point. While on the one hand they bear clear evidence of the operation of sociological factors, in fundamental features common to both, the minor variations are not reducible to such causes, and must be referred to the psychologico-linguistic agencies of Kroeber.

*The Sacred Literature of the Cherokee:* JAMES MOONEY.

The Cherokee Indians were the aboriginal moun-

taineers of the southern Alleghanies, holding undisputed possession of a territory of some 40,000 square miles, with a population of about 25,000, being numerically, historically and culturally the most important single tribe within the United States. In 1838 the bulk of the tribe removed to what is now Oklahoma, but some 1,800 still remain in their native mountains, keeping up fairly well their purity of blood and their ancient languages and customs. Their native culture reached its highest point with the invention of the Cherokee syllabic alphabet by a mixed-blood of the tribe about the year 1820. The system was at once adopted by them for purposes of book and newspaper publication, current record and correspondence, and even as a medium of instruction in their schools. At the same time their priests and doctors seized the opportunity to preserve in permanent form for their own secret use the ritualistic formulas and occult knowledge which had hitherto been transmitted orally and confined to the keeping of initiates of exceptional power of memory.

In a study of the tribe extending at intervals over a period of thirty years Mr. Mooney has been so fortunate as to obtain the original Cherokee manuscripts embodying virtually the whole of this ancient ritual, as recorded by noted priests dead many years ago. They cover the whole range of Indian interest—war, love, hunting, fishing, agriculture, gaming and medicine—and are without parallel as a revelation of the Indian spiritual idea. The expression of the formulas is archaic and symbolic, and frequently of high degree of poetic beauty. Mr. Mooney has them now in preparation for publication by the Bureau of American Ethnology.

*Sauk and Fox Notes:* TRUMAN MICHELSON.

The writer's phonetic scheme of the Fox dialect differs in certain respects from that of the late Dr. William Jones. These differences consist mainly in the position of the accent, the quantity of vowels, the quality of *o* and *u* vowels, and aspirations. Some of these differences can be explained if we assume that Dr. Jones was influenced by the Sauk dialect. It is clear that the verbal complex will have to be viewed from a different psychological point of view than has obtained hitherto. A few obscure grammatical points have been elucidated.

The regulations concerning membership in the tribal dual division of the Sauk are not clear, whereas those governing membership in the tribal

dual division of the Foxes have been definitely ascertained. That the dual division among the Foxes is ceremonial and not merely for athletic purposes has been amply confirmed.

The ritualistic myths on the origin of sacred packs, especially those belonging to entire gentes, are all of one and the same type. They were doubtless invented in the remote past to account for existing ceremonies.

*Le Verbe dans les Adjectifs et les Adverbes Porteurs:* A. G. MORICE.

In the Carrier (Porteur) dialect of the Dene language there is scarcely any regular adjective in our sense of the word. Practically all the qualificative adjectives are regular verbs, which may be divided into primary and secondary. The former have several forms that change not only according to the nature of the nouns they qualify, but also when they imply some comparison. Besides those two categories, the Carrier language contains also a third class of verbal adjectives, which may be called composite adjectives, and are distinguishable by their being made up of an impersonal verb and a pronominal prefix. A few adverbs are likewise occasionally conjugated.

*Terms of Relationship and the Levirate:* E. SAPIR.

Evidence has recently been adduced from Melanesia and other parts of the world to show that specific features of relationship systems are frequently explainable as due to definite types of marriage. Evidence here presented from aboriginal America shows that in some systems certain relationship terms imply the custom of the levirate, that is, the marrying of the deceased wife's sister, and its correlate, the marrying of the deceased husband's brother.

*The North Building of the Great Ball Court, Chichen Itza, Yucatan:* ADELA BRETON.

The detached building (called Chamber C in Dr. A. P. Maudslay's survey) at the northern end of the great Ball Court had a single long, narrow chamber, the inner walls covered with sculptured human figures in relief. These are of great interest and appear much older than those of Chamber E, below Temple A (the Temple of the Tigers). Although part of the vaulted roof remains, and though hardest limestone was used, it is so weathered that prolonged study is needed to see the details. The stones are not large and appear to have been removed from some other building and re-erected. Instead of the regular rows of armed warriors that cover all three walls in Chamber E, there are here two principal groups and a number

of detached figures conversing, in twos and threes, whose relation to the whole is difficult to understand. At the base of the walls is a flowery border, separated by a blue band from the figures, and the colors were still visible in this border in 1902. The recumbent personage of the paintings in Temple A occupies the center. Above, there is first a sort of altar with an animal laid on it and five chiefs standing on either side. The next set higher has a seated chief with the feathered rattlesnake. Facing him stands a being in a garment of scales and surrounded by flames or tongues. Five chiefs on either side, seated on round stools and carrying atlatis, complete this group. The sculptures on the two round columns which divide the entrance are particularly fine.

Excavation in the center of the chamber floor exposed a massive round stone cist with heavy cover finely wrought.

*Pocomchi Notes:* ADELA BRETON.

The Berendt manuscript collection in the library of the University Museum of Philadelphia contains three "Doctrinas" in Pocomchi, a volume of sermons at Tactic, 1818-20, with Spanish translations, a confesionario of 1814, and a fragmentary original vocabulary. The "Doctrinas" can be studied only by making a parallel copy of the three, so that the varieties of misspelling may be compared. One is dated 1741, by H. Aguilera, Cura of Tactic, but is a poor copy. Another is a copy from a manuscript at Tactic of 1810. The third is evidently taken from that, and is in Villacorta's "Doctrina en lengua Castellana Quekchi y Pocomchi," made at Coban, 1875. The ignorance of the copyists is well shown in these.

Thomas Gage, the Dominican who was in Guatemala for several years about 1680, was advised to study Pocomchi as it was most spoken about there and in Vera Paz, Salvador. He calls it Pocomchi or Pocoman and most elegant. In three months he learned enough to be able to preach. The rudiments given in his work served Dr. Stoll in his study of the modern language, but this differs much from the vocabulary. Gage was intimate with Moran, who may have written the vocabulary. This consists of 290 closely written pages, portions of original volumes many times larger. The writer was living at San Cristobal Cahcoch, near Coban, and introduces much information as to the character and habits of the people. Knowledge of ancient customs was disappearing. They no longer used stone axes nor trumpets made from calabashes, and only a few remember the name Poytan

for wall-coverings or tapestries, such as were seen in dwellings of rich Spaniards in the capital. In 1814 they still believed in dreams, wizards and the power to change into animals.

The great variety of suffixes used with numerals is a striking feature. The highest named number was 160,000 with multiples. There was no word for temple. In relationship, brother and first cousin were expressed by the same term. The writer mentions Pocoman only as the name of the people. He quotes constantly from Padre Viana's "Vita Christiani."

*Some Aspects of the Land as a Factor in Mexican History:* LEON DOMINIAN.

The relief of the land has afforded certain lines of easiest access to the plateau region. The line of advance of the Mexicans in the course of their early migrations, the routes followed by the white man in modern times, and railway penetration have all been determined by preexisting natural routes. Settlement has taken place mainly on the plateau and above the 4,000-foot contour. This region constitutes the only favorable human habitat within present Mexican territory, hence is explained the excess of population and of the existence of the larger cities on the plateau. Physical conditions within this tableland have affected the social status of the inhabitants at all times. The want of political union found by Cortes and manifest throughout known Mexican history is largely the result of the conspicuous lack of means of communication. Navigable rivers are not found in Mexico, while the mountainous and intermontane regions are characterized by a succession of narrow valleys, each practically walled up from the others by intervening ridges over which travel is arduous. In the same way the Mexican form of land tenure can be traced to the occurrence of large arid areas. The inhabitants of the three tierras reflect respectively the conditions which surround them. From the standpoint of continental relations, Mexico is a transition zone, both physical and human. In the former case the salient features of North American physiography are prolonged into Mexico to end in the vicinity of the Isthmus of Tehuantepec. In the latter the country can be considered as the link connecting Anglo-Saxon and Latin America.

*Incense Burners from a Cave near Orizaba:* H. NEWELL WARDLE.

The Lamborn Collection of the Academy of Natural Sciences of Philadelphia contains four curious earthenware beasts, found in a cave near Ori-

zaba, Mexico. Two of the monsters have supported incense-pans, and two were probably attached to and form a part of such cultus objects of a cave temple. The types are believed to be previously undescribed, but show affinities both in form and in style of art to the cultus objects from the ancient religious center of Chavclá, Guatemala. Their relationship to the distribution and significance of the cave god is briefly considered.

*The Rain Ceremony as Practised to-day by the Maya Indians of Southern Yucatan and Northern British Honduras:* THOMAS GANN.

The paper describes the ceremony as practised by the Santa Cruz, Icaiche and Xcanha Indians, and the mixed Indians inhabiting the northern portion of British Honduras, and indicates points of resemblance between the ceremony and various ceremonial religious procedures of the Maya of Yucatan at the time of the conquest, as well as of the modern Lacandon Indians.

*Climatic Changes and Maya Civilization:* ELLSWORTH HUNTINGTON.

In the search for the causes of the rise and fall of civilization the Maya hold a peculiarly important place, since they afford an independent American means of testing conclusions reached in the Old World. Perhaps the most striking fact about the Maya civilization is that it developed in a region where agriculture is to-day extremely difficult or well-nigh impossible, where tropical fevers are at their worst, where the hot, damp climate is in itself highly enervating, and where neither the natives nor the people of Spanish descent have been able to make any progress. In the better climate of the Yucatan coast and of the Guatemalan plateau, however, the physical conditions are far more favorable, and a certain amount of progress can now be seen. This suggests that when the Maya flourished the climate can scarcely have been so unfavorable as at present.

In the corresponding parts of Asia, that is in Indo-China and the East Indies, similar ruins are found in a similar geographical environment. Farther north in the desert belt of both America and Asia there is abundant evidence of an irregular shifting backward and forward of the rainy conditions of the temperate zone into and out of the present arid regions. This process would naturally force the dry belt alternately to invade the Maya region, causing dry conditions favorable to the civilization, and to retreat from it, causing the present unfavorable conditions. Recent investigations of the chemical history of the salt lakes of



California and Nevada have greatly strengthened this "pulsatory" hypothesis, as it is called. If the hypothesis is well grounded, the course of history in all parts of the world must have been profoundly modified by repeated climatic changes which have been powerful factors in the fall of civilization at certain times and its rapid development at others. Thus the correct interpretation of the general course of Maya history, and especially the establishment of an unimpeachable chronology, assumes added importance. It will furnish one of the most critical tests of an hypothesis which, if true, will demand a widespread remodeling of the established ideas as to the conditions necessary to the advancement of civilization.

*The Hotun as the Principal Chronological Unit of the Old Maya Empire:* SYLVANUS GRISWOLD MORLEY.

Nine years ago attention was attracted by a certain periodicity in the occurrence of the dated monuments at Quirigua, eastern Guatemala, a condition previously noted but not at that time definitely established.

The Quirigua monuments were found to follow each other at intervals of 1,800 days, and, although the sequence was then incomplete, subsequent studies at the ruins in 1910-14 have resulted in filling all the lacunae, and in finding a corresponding monument for every 1,800-day period during which the city seems to have been occupied.

Later investigations, particularly during the last two years, at all the principal Old Empire sites, amply established the former prevalence of this same periodicity in the occurrence of the dated monuments, and furthermore have resulted in the identification of the glyph for this 1,800-day period for which the name *hotun* is here suggested, as well as that for the 3,600-day period for which the name *lahuntun* is suggested. Indeed the practise seems to have been so universal during the Old Empire that it is possible to formulate the following general thesis based upon it:

The stela type of monument seems to have been used primarily to record the passage of time, stelae being erected at intervals of every *hotun* (1,800 days), or even multiples thereof, as *lahuntuns* (3,600 days), or *katuns* (7,200 days), throughout the Old Empire, approximately A.D. 200 to A.D. 600.

The paper offers this thesis to Maya archeologists, and presents coincidentally a partial summary of the evidence on which it is based, illustrated with photographs, maps and diagrams.

*The Chilam Balam Books and the Possibility of their Translation:* ALFRED M. TOZZER.

Owing to the large amount of original manuscript material made available during the last two years by Professor William E. Gates, a great opportunity is offered to Maya students for the study and translation of the Chilam Balam books. With photographic copies of the Motul and San Francisco dictionaries, and copies of all the known original Chilam Balam books, one has for the first time the material at his disposal.

As Brinton remarked many years ago, "The task of deciphering these manuscripts is by no means a light one." The importance of the results which may be expected should serve as a powerful incentive to all Maya students. The task is not an impossible one. There are certainly some passages which will never be translated. The books, as they now appear, are copies made chiefly in the eighteenth century or earlier works going back in some cases probably to the sixteenth century. The text as a consequence has suffered badly. The copyist shows in many cases an ignorance of Maya, and, in some instances, a surprising ignorance of Spanish. In several cases Latin words appear in an almost unrecognizable form. The Maya is most arbitrarily separated into several different ways on the same page. The punctuation is also never consistent.

The few passages already translated show the great importance attached to the manuscripts. The chronological parts have already served to make possible the coordination of Maya and Christian chronology. These portions are, of course, of primary importance. The parts dealing with prophecies and the good and bad days of a year are other parts worthy of study. There is much that is almost entirely Spanish in character, with little reflection of the native element. The medical parts figure largely in many of the manuscripts. In most cases the directions for curing various kinds of illness are entirely Spanish in origin. The Christian teaching with the "Doctrinas," the astrological information, and discussion of the Zodiac, as in the Kaua manuscript, have little of interest for students of precolumbian history as compared with those portions dealing with the ancient chronology and the history of the wanderings of the Maya.

In addition to the translations, a careful collation of the material from all the manuscripts is absolutely necessary. The reconciliation of the various statements regarding similar events in the

different books will be no less difficult than the simple translation of the Maya text.

*Recent Progress in the Study of Maya Art:* HERBERT J. SPINDEN.

The historical arrangement of sculptures at Copan has now been reduced to great certainty, and there is hardly a monument that after examination of the carving can not be dated within twenty years. Mr. S. G. Morley has succeeded in deciphering most of the inscriptions, and there is entire agreement between the dates and the stylistic sequence. At cities that flourished in the Great Period (455-600 A.D.) the criterion of sequence is seen mostly in the progressive elaboration of designs by flamboyant details. It is necessary to treat homogeneous material. At Quirigua the faces carved on the tops of the boulder altars furnish an interesting series. At Naranjo the ceremonial bar passes from comparative simplicity to extreme complexity, and the change is in accordance with the inscribed dates. Piedras Negras proved to be the most interesting of the sites visited by Mr. Morley and the writer in 1914. The monuments give an especially full account of the Middle Period and extend well into the Great Period. Four monuments, representing the same subject, with considerable intervals of time, show a remarkable increase in design elaboration.

In spite of provincialism that appears in some sites we are now able to strike the general levels of artistic development in practically all Maya cities of the First Empire (200-600 A.D.). Progressive changes in the construction and ornamentation of buildings is seen very clearly at Yaxchilan. The most interesting problems are those of roof-comb support and the origin of the sanctuary. Several Yaxchilan temples have dated lintels which bring the sequence in architecture in touch with sequence in sculpture.

*On the Origin and Distribution of Agriculture in America:* HERBERT J. SPINDEN.

Without agriculture none of the high civilizations of the New World would have been possible. Agriculture was independently developed in America because the plants under domestication are different from those of the Old World. It probably had one point of actual origin and that was in the region where maize grew wild. This region was pretty clearly the highlands of Mexico and Central America. Maize, with beans and squashes, are found throughout the area of agriculture. Secondary centers in which special plants were brought under cultivation are seen in

Peru, the lower Amazon valley, etc. In the region north of Mexico all cultivated plants (except tobacco) were introduced, and none is indigenous; therefore the pueblo and mound cultures are not strictly autochthonous.

Pottery and weaving are practically dependent on agriculture. The earliest pottery of Mexico—that of the so-called Archaic culture—seems to have developed soon after the rise of agriculture and to have been carried well into South America with the same cultural stream that carried agriculture. A peculiar technique can be traced without change to the Isthmian region, and with progressive modifications, under which the original features can still be seen, it can be traced to southern Colombia and well into Venezuela.

*Résumé of Recent Excavations in Northern Yucatan:* EDWARD H. THOMPSON.

A résumé of the excavations conducted in and about northern Yucatan up to the time of the first Peabody Expedition of Harvard University to explore the Cave of Soltun and the ancient group of Sabná.

Sabná, the first ruin group on the peninsula of Yucatan to be scientifically excavated and surveyed. Detailed methods described, and some of the interesting results obtained.

Kichmook, the second ruin group on the peninsula to be systematically excavated and scientifically studied.

Excavation, conducted subsequently to those above named, in the ancient sites of Chichen Itza, Mayapan, Acanceh, Tiho, etc.

*The Maya Zodiac of Santa Rita:* STANSBURY HAGAR.

A number of years ago Dr. Thomas Cann excavated on the estate of Santa Rita, near Corozal, in British Honduras, a rectangular building, the walls of which were covered with stucco paintings of the pre-Cortesian period. Those on the north will present a continuous series of Munan figures associated with conventional symbols of glyphs, and some of them holding a rope. The whole may be interpreted as a picture of the cosmos with the sky and stars above, the earth below, and the waters under all. The figures and symbols repeat the zodiacal sequence found in the constellations of Tezozomoc, Sahagun and Duran, the Maya day-signs, the paintings at Mitla and Acanceh, the various pictorial sequences in the codices. They seem, therefore, to represent the asterisms, deities and day-signs of the Maya zodiac in a correct and continuous sequence, the rope being that of the ecliptic or zodiac. A Nahua element is prominent

in this zodiac, and its symbols reveal intimate correspondence with those of other native zodiacs in Yucatan, Mexico and Peru; also in lesser degree with the zodiac which we have received from the prehistoric Orient.

*Archeological Studies in Northwestern Honduras:*  
MARSHALL H. SAVILLE.

During the summer of 1915 the writer and his son made a reconnaissance in the department of Cortés, Honduras. An examination was made of the archeological conditions along the Ulua River, previously reported on by Gordon. An important collection of antiquities was brought together illustrating the complex features of this section of Central America, objects of several well-known and far-distant cultures being found in the restricted area of the broad valley in which flows both the Ulua and Chamelicon rivers. Pottery vessels recalling Tarascan, Nahuatl, Costa Rican and Colombian ware in shape and decoration were found, as well as the characteristically Mayan type of polychrome and undecorated vessels. Jadeite ornaments of unquestioned Costa Rican origin occur, and two well-defined examples of the "palma-stones" of the Totonacan class of sculptures of Vera Cruz were collected.

In the mountains toward the department of Santa Barbara, several large groups of mounds were visited, the unknown groups of Manchagualla and Chasnigua being of particular interest for further investigation and excavation. Mounds and village sites were found also near the borders of Lake Yojoa.

It is the intention of the Museum of the American Indian in New York to make a survey of Mosquitia, the region lying along the Caribbean Sea, from the vicinity of the mouth of the Ulua River to Bluefields, embracing a vast strip of territory, partly in Honduras, partly in Nicaragua. This area is little known geographically, and less so archeologically. Information was obtained showing Nicaraguan and Costa Rican resemblances in the antiquities, such as animal-shaped metates and stools, reported in this country, and shown by several examples in the collections of the Museum of the American Indian, collected many years ago by the late Dr. Joseph Jones.

GEORGE GRANT MACCURDY,  
(To be continued) Secretary

#### SOCIETIES AND ACADEMIES

THE BIOLOGICAL SOCIETY OF WASHINGTON  
THE 554th regular meeting of the society was held in the Assembly Hall of the Cosmos Club,

Saturday, April 8, 1916, called to order by President Hay at 8 P.M. with 65 persons present.

The president called attention to the recent death of Wells W. Cooke, treasurer of the society, and announced the appointment of Messrs. Hollister, Gidley and Wetmore to draw up appropriate resolutions.

The president also announced that the council had elected Dr. Ned Dearborn to the vacancy caused by treasurer Cooke's death, and also of his appointment to the committee on publications.

On recommendation of the council the following persons were elected to active membership: Robert M. Libbey, Washington, D. C., G. K. Noble, Museum of Comparative Zoology, Cambridge, Mass., and Dr. Howard E. Ames, U. S. Navy (retired).

The following informal communications were made:

Dr. R. W. Shufeldt commented upon and exhibited specimens of a Japanese salamander, *Diemictylus pyrrhogaster*, obtained from a local dealer in live animals.

Dr. Paul Bartsch called attention to the introduction of European agate snail *Rumina decollata* in certain parts of the southern states; and to the recent publication by J. B. Henderson of a book entitled: "The Cruise of the *Tomas Barrera*," the narration of a scientific expedition to western Cuba and the Colorado Reefs, with observations on the geology, fauna and flora of the region.

Dr. M. W. Lyon, Jr., made remarks on the history of the *Filaria bancrofti* embryos exhibited at the previous meeting of the society.

Mr. F. Knab discussed the mosquito host of *Filaria bancrofti*, saying that an appropriate species of *Culex* is found in Washington in the late summer.

The regular program was an illustrated lecture by Mr. Edmund Heller entitled "Hunting in the Peruvian Andes." Mr. Heller gave an account of a recent collecting trip made by him from the west coast of Peru up into the high Andes and down to the headwaters of the Amazon. He described the animals collected, mainly mammals, but also birds and reptiles, including the rare spectacled bear, wild llamas, etc. He also commented on the habits and customs of the natives. He showed photographic lantern slides not only of the wild life, the inhabitants and physiographic features but also of many points of archeological interest.

M. W. LYON, JR.,  
Recording Secretary